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10/827,405	04/20/2004	So-young Kim	Q80509	2940

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EXAMINER	
WERNER, DAVID N	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/827,405	KIM ET AL.	
	Examiner	Art Unit	
	David N. Werner	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-58 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-58 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 20 April 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 20040420.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This is the First Action on the Merits for US Patent Application 10/827,405, which claims foreign priority from Korean Application 10-2003-0027540, filed 30 April 2003. Currently, claims 1-58 are pending.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 57 and 58 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette Notice of 22 November 2005), Annex IV, read as follows:

> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See *Lowry*, 32 F.3d at 2583-84, 32 USPQ2d at 1035.
>
> Claims that recited nothing but the physical characteristics of a form of energy, such as a frequency, voltage, or the strength of a magnetic field, define energy or magnetism, *per se*, and as such are

> nonstatutory natural phenomena. See *O'Reilly*, 56 U.S. (15 How.) at 112-114. Moreover, it odes not appear that a claim reciting a signal encoded with functional descriptive material falls within any of the categories of patentable subject matter set forth in Sec. 101.
>
> ...a signal does not fall within one of the four statutory classes of Sec. 101.
>
> ...signal claims are ineligible for patent protection because they do not fall within any of the four statutory classes of Sec. 101.

Claims 57 and 58 are drawn to a "computer-readable recording medium" "recording" functional descriptive material. Normally, the claims would be statutory. However, the specification, at paragraph 196, define the claimed computer-readable medium as encompassing statutory material such as a "memory", or a "disk", as well as *non-statutory* subject matter such as "a carrier wave", or a "network".

A "signal" embodying functional descriptive material is neither a process nor a product (i.e., a tangible "thing") and therefore does not fall within one of the statutory classes of §101. Rather, a "signal" is a form of energy, in the absence of any physical structure or tangible material. See *In re Nuijten*, 84 USPQ2d 1495 (Fed. Cir. 2007).

5. Because the full scope of the claims as properly read in light of the disclosure encompasses non-statutory subject matter, the claims as a whole are non-statutory. The examiner suggests amending the specification to exclude the non-statutory matter from the definition of a "computer-readable medium" on which the claimed program is stored.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 1, 12, and 57 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Step (d) of claim 1 refers to determining whether a number is "two or more and is (2M-1) or less". Additionally, M is given as an integer equal to or larger than 1. Then, when M equals 1, the expression (2M-1) equals 1. Since no number can be simultaneously greater than 2 and less than or equal to 1, step (d) of the method of claim 1 cannot be performed when M=1. For the further purposes of examination, it will be assumed that M must be greater than or equal to 2.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 20-23, 29, 30, 32, 39-41, 47, 48, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,502,492 A (Jung) in view of US Patent 4,944,023 (Imao et al.). Jung teaches a motion vector determining system in which large "panning blocks" in a video frame are subdivided into smaller "subblocks", and the

motion vectors of these subblocks are calculated. Regarding claims 20, 39, and 58, in Jung, subblock motion vector detector 20 detects motion vectors for each of the subblocks of the larger panning blocks within a frame (column 3: lines 7-28). This corresponds with step (a) of the method of claim 20 and the motion estimator of claim 39. Motion vector detector 20 in Jung includes a set of shifting and blocking circuits 114-118, which produce motion vectors, and also includes a set of comparators 12—124, which produces error, or difference values (column 3: line 47–column 4: line 9). These error values correspond with the claimed "predetermined measure". Motion vector detector 20 of Jung also includes a subblock divider 110, which divides a large panning block into the several subblocks (column 3: lines 47-53). This corresponds with the claimed "block divider" of claim 39. Next, the number of subblocks that have an identical displacement is determined (column 4: lines 33-44). If there are multiple sets of subblocks with different identical displacements, the displacement with the largest number of subblocks is used (column 4: lines 45-59). If the number of subblocks having an identical displacement is larger than a certain threshold, preferably 30% of the subblocks in the panning block, then the motion vector for the current panning block is the overall panning block motion vector determined from panning vector 30 (column 5: lines 4-29). This corresponds with step (c) of the method of claim 20 and claim 41. However, in Jung, there is only one subdivision of blocks into subblocks, not a plurality of subdivisions of subblocks into a second series of subblocks.

Imao et al. teaches a method of describing an image by recursively dividing an image. Regarding claims 20 and 39, in Imao et al., several embodiments exist, but all

are directed to recursively dividing an image of n-dimensional space into 2^n regions until each of the regions contains only one kind of region (column 1: line 52–column 3: line 34). This corresponds with step (b) of the method of claim 20 and the block mode determination unit of claim 39.

Jung discloses the claimed invention except for hierarchically or recursively dividing image blocks into subblocks. Imao et al. teaches that it was known to recursively divide an image into subregions. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute the recursive division of images of Imao et al. for the single-level division of Jung to obtain the predictable result of determining, with variable granularity, which areas of an image have the same motion vector, since it has been held that simple substitution of one known element of an invention for another to obtain predictable results has been found to be within the level of ordinary skill in the art. See *In re Fout*, 675 F.2d 297, 301, 213 USPQ 532, 536 (CCPA 1982); *In re O'Farrell*, 85 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988); *Ruiz v. AB Chance Co.*, 357 F.3d 1270, 69 USPQ2d 1686 (Fed. Cir. 2004, and *Ex parte Smith*, 83 USPQ2d 1509 (BPAI 2007).

Regarding claim 21, in Imao et al., a tree is formed by recursively dividing a region into four subregions, and determining if the subregions are uniform. If the subregions are uniform, then the current region becomes a leaf node in the tree (column 7: lines 28-56). This corresponds to step (a1). The values of the four subregions of the current region, if uniform, correspond to the claimed combined values of the measure

function in step (a2). Regarding claims 22 and 40, in Imao et al., uniformity is determined according to similarity of a value in a region. In the example given in Imao et al., a binary image is used, and the value is the color of the region (column 8: lines 18-42).

Regarding claim 23, in Jung, as stated above, if a certain number of subblocks above a threshold have an identical displacement, then the motion vector for the panning block is the one taken for the panning block as a whole from the panning vector detector (column 4: lines 4-15).

Regarding claims 29 and 47, in Jung, motion vectors are considered similar if they have an identical displacement (column 4: lines 30-44).

Regarding claims 30 and 48, in Jung, motion vector error may be determined in one of several standard methods, including mean-square error.

Regarding claims 32 and 50, a limit L is defined as a number in a sequence a(n) such that for every small $\varepsilon > 0$, there exists a number N such that the absolute difference between the nth or greater value in the sequence and L is less than ε. See *Mathematical Thinking* (D'Angelo et al.), pg. 259. In other words, if a limit of a sequence exists, it is possible to arbitrarily approach the limit over the sequence. In the present case, the "difference between values of two measure functions" is a(n) for n greater than or equal to N, L is zero, and ε is the predetermined range. N is the boundary for determining similarity. Two functions are similar at a given block if the difference between their values at that block can arbitrarily approach zero.

10. Claims 24, 28, 31, 42, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung in view of Imao et al. as applied to claim 20 above, and further in view of US Patent 5,903,669 A (Hirabayashi). Claims 24 and 42 of the present invention are directed to dividing a 16 x 16 pixel macroblock into four 8 x 8 sub blocks. However, in Jung, the subblocks, not the large blocks, are size 16 x 16 pixels (column 3: lines 50-51), and in Imao et al., although regions are divided into northwest, northeast, southwest, and southeast subregions (column 5: lines 13-16, 41-48), it is not specified that the first division is into regions of size 16 x 16 pixels and subregions of size 8 x 8 pixels. Additionally, Claim 28 of the present invention is directed to determining a block mode based on the amount of data produced from the preliminary block modes, whereas Jung determines block mode based on the accuracy of prediction of the block from the preliminary block modes.

Hirabayashi teaches an image processing system that produces blocks of various sizes. Regarding claims 24 and 42, in figure 1 of Hirabayashi et al., block forming unit 1 first divides an image into square blocks each having 16 by 16 pixels, and block size discrimination unit 2 determines if the blocks will further be divided into subblocks. Subblock forming unit 3 then divides the blocks into subblocks (column 2: lines 39-55). The 16 by 16 pixel blocks are first divided into 8 x 8 subblocks, and further into 4 x 4 subblocks, 2 x 2 subblocks, and 1 x 1 pixel subblocks, if necessary (column 3: lines 1-15).

Regarding claims 28 and 46, Hirabayashi determines whether to subdivide a block by comparing the amount of data produced by the block and the combined data from the four subblocks from the division of the current block (column 3: lines 20-25).

Regarding claims 31 and 49, recall that in Hirabayashi, the determination of coding mode is made with respect to the amount of data coded in each coding mode (column 3: lines 20-25). In addition, in the figure 9 embodiment of Hirabayashi, data is transformed by differential coding (column 5: line 38–column 6: line 42). A difference between the average pixel value in the data block and each pixel in the data block is output in this embodiment, and so the amount of data output is a sum of absolute transformed difference.

Jung, in combination with Imao et al., teaches the known invention except for determining block mode based on amount of data produced. Hirabayashi teaches that it was known to determine a block coding mode based on the amount of data produced from a large block or a combination of subblocks. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to determine whether to encode a block as a large block or as a series of subblocks according to the amount of data produced, as taught by Hirabayashi, since Hirabayashi states in column 1: lines 49-57 that such a modification would increase the compression ratio of the encoded video.

11. Claims 1-19, 25-27, 33-38, 43-45, and 51-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung, in view of Imao et al. and Hirabayashi, as applied to

claims 24 and 42 above, and further in view of US Patent 5,796,434 A (Lempel). Claims 25-27 and 43-45 are directed to determining if motion vectors of adjacent blocks are similar. However, Imao et al. and Hirabayashi produce strict quadtree subdivisions of blocks, not producing additional modes in which two adjacent subblocks can be combined based on similarity.

Lempel teaches a motion vector estimation system that operates in the transform domain. Lempel first divides images into target blocks for motion vector search (column 6: lines 18-35), and determines the target block in a target frame that is the most similar to a current block in a current frame (column 6: lines 36-53). Next, the target blocks and current block are divided into subblocks, and the DCT is taken over the subblocks (column 6: lines 55-63). The DCT for each of the subblocks is stored in a memory, so they can be re-used if needed in additional calculations (column 6: lines 6—63), such as re-combining two subblocks into larger regions, as will be explained in greater detail below.

Regarding claim 25 and 43, in Lempel, a search frame is additionally partitioned into horizontal bands of size 16 x 8 pixels (column 6: line 64–column 7: line 4; column 17: lines 13-42). If a current block is not found to line up well with a target block, but instead overlaps two vertically adjacent target blocks, then the two target blocks are included as candidate blocks (column 23: lines 1-55).

Regarding claims 26 and 44, a search frame may also be divided into vertical bands of size 8 x 16 pixels (column 7: lines 4-18; column 17: lines 11-36), that can be used if a current block is found to overlap two horizontally adjacent target blocks.

Regarding claims 27 and 45, if the best match for a current block is found to be both on a vertical border between an upper row and lower row of macroblocks, and a horizontal border between a left column and right column of macroblocks, then the sub-blocks that form the intersection of candidate blocks that align with the current block are used (column 20: lines 31-42).

Jung, Imao et al., and Hirabayashi disclose the claimed invention except for determining motion estimation by combined adjacent subblocks. Lempel teaches that it was known to perform a motion estimation search based on sets of two adjacent subblocks. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate an adjacent subblock motion estimation search into the motion vector detection system of Jung, as taught by Lempel, since Lempel states in column 5: lines 1-55 that such a modification would reduce error in performing motion estimation by enabling motion estimation to be done in the frequency domain.

Regarding claims 33-38 and 51-56, this is simply the next iteration of Imao et al. as applied to claims 20, 24-28, 39, and 42-46 above over an 8 x 8 subblock if it has been found that the 8 x 8 subblock is not uniform, that is, it does not have a single motion vector. Claims 33 and 51 correspond with claims 20 and 39; claims 34 and 52 with 24 and 42; claims 35 and 53 with 25 and 43; claims 36 and 54 with 26 and 44; claims 37 and 55 with 27 and 45; and claims 38 and 56 with 28 and 46.

Regarding claims 1 and 12, when N equals 2, the current picture becomes equivalent to an MPEG B frame, having 2 reference pictures. Also, it is inherent that if

two sub blocks have the same motion vector, they have the same reference picture, and if two sub blocks have different reference pictures, they have different motion vectors. Then, the determination of if sub blocks have the same reference picture is considered equivalent to the determination if sub blocks have similar motion vectors. In other words, the method of claim 1 is considered equivalent to the method of claims 20 and 24-26 for a bidirectional picture, and the apparatus of claim 12 is considered equivalent to the apparatus of claims 39 and 42-44, previously rejected under Jung, Imao et al., Hirabayashi, and Lempel, for a bidirectional picture. It is noted that Lempel operates on MPEG data, and specifically states that "bi-directional pictures...require both a past and a future reference in order to be encoded" (column 2: lines 48-50).

Regarding claims 2 and 13, the method of grouping adjacent subblocks is equivalent to the dividing of search frames into horizontal or vertical strips or bands in Lempel.

Regarding claims 3 and 14, the further subdivision of first subblocks into second sub blocks if the first subblocks use different reference pictures is the second iteration of the division of an image in Imao et al., in which the test for uniformity of regions is if the regions have the same reference picture.

Regarding claims 4 and 15, Hirabayashi determines whether to subdivide a block by comparing the amount of data produced by the block and the combined data from the four subblocks from the division of the current block (column 3: lines 20-25), in a similar manner to claims 28 and 46 discussed above.

Regarding claims 5 and 16, in Jung, if a certain number of subblocks above a threshold have an identical displacement, then the motion vector for the panning block is the one taken for the panning block as a whole from the panning vector detector (column 4: lines 4-15), in a similar manner to claim 23 discussed above.

Regarding claims 6 and 17, in Jung, motion vectors are considered similar if they have an identical displacement (column 4: lines 30-44), in a similar manner to claims 29 and 47 discussed above.

Regarding claims 7 and 18, as mentioned above, Lempel divides 16 x 16 pixel target blocks into 8 x 8 subblocks (column 19: line 38), and recombines adjacent 8 x 8 subblocks into 16 x 8 or 8 x 16 horizontal bands (column 20: lines 5-20).

Regarding claims 8 and 19, Jung determines motion vector coding error "by employing any of the algorithms well known in the art" (column 4: lines 1-6). Although sum of absolute difference (SAD) is not given in the non-exhaustive list of error metrics provided, the examiner takes Official Notice that determining accuracy of motion estimation using a Sum of Absolute Difference measure was well-known in the art, if not the most common method, at the time the invention was made.

Regarding claim 9, Lempel states that coding a bi-directional MPEG picture requires two reference pictures (column 2: lines 48-50).

Regarding claims 10 and 11, the examiner takes Official Notice that it was known in the art that in encoding bidirectional pictures, that once a predetermined block mode for encoding a block has been determined, it would be expected to encode the block using the determined block mode.

Regarding claims 57 and 58, Lempel is embodied on a general purpose computer (column 8: line 15–column 9: line 35).

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- US Patent 5,021,891 (Lee)
- US Patent 5,148,269 A (de Haan et al.)
- US Patent 5,228,098 A (Crinon et al.)
- US Patent 5,241,395 A (Chen)
- US Patent 5,446,806 A (Ran et al.).
- US Patent 5,748,788 A (Moro)
- US Patent 5,790,20 A (Ju)
- US Patent 6,529,634 B1 (Thyagarajan et al.)
- US Patent 6,539,119 B1 (Kondo et al.)
- US Patent Application Publication 2003/0007698 A1 (Govindaswamy et al.)
- "Quadtree-Structured Variable-Size Block-Matching Motion Estimation with Minimal Error" (Rhee et al.).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David N. Werner whose telephone number is (571) 272-

9662. The examiner can normally be reached on Monday-Friday from 8:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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